



CONTACT INFORMATION
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QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

January 18, 1973

1024 ONB Build
Mr. Joseph E. Worthington
U.S. Manager of Exploration
Cyprus Mines Corporation
W. 422 Riverside Avenue
Spokane, Washington 99201

Dear Mr. Worthington:

This letter report covers the gravity survey along Copper Creek Road, located in Ranges 17 and 18 East, Township 8 South, east of Mammoth, Pinal County, Arizona. One gravity traverse was run, beginning 0.75 miles east of Mammoth and continuing east along Copper Creek Road for a distance of approximately seven miles, as shown on the Gravity Traverse Location Plan, which is a composite of the U.S.G.S. Mammoth, Clark Ranch and Holy Joe Peak 7.5 minute quadrangle maps.

The purpose of the survey was to determine if basin and range faulting may have modified the bedrock surface west of the Border Fault, helping to explain the rather extensive thickness of gravels encountered by drill holes in sections 13 and 18.

A total of 37 gravity stations were run with a station interval of approximately 1/4 mile. Survey control was accomplished with a vehicle odometer in conjunction with the 1:24,000 scale topographic maps. Station locations are accurate to approximately 50 feet or better. Elevation control between established bench marks was accomplished with two aircraft barometric altimeters, one as a base station monitor, the other to measure the elevations of the various gravity stations. Elevations, after corrections for drift were made, are accurate to about 10 feet. Gravity readings were taken with a Worden

See NUCAS
File for
Diagrams
(Plan & Profile)
Jobs 803 &
807

Mr. J. E. Worthington
January 18, 1973
Page Two

gravimeter. In addition to the standard drift corrections, corrections were made for the combined free air and Bouguer effect and the latitude. For the Bouguer correction a density of 2.1 grams/cc was assumed for the overlying Gila Conglomerate, as suggested by Dr. Brant in his paper in "Geology of the Porphyry Copper Deposits" edited by Titley and Hicks. The gravity data is presented in profile form along with the corresponding total magnetic and topographic relief, also shown in profile form. The magnetic information was taken from the U.S.G.S. Aeromagnetic Map of the Mammoth Quadrangle flown at 1000' above terrain, in 1947. All data taken in the field was plotted first on the 1:24,000 scale topographic maps of the area, then projected north to a common east-west base line; therefore, distances on the profile map reflect the east-west component between stations.

GEOEX personnel on this project were Phil Matthews, geophysicist, and Allan Moran, geologist. This report and interpretation are by Phil Matthews assisted by the GEOEX Tucson staff.

The gravity profile shows a high at both ends and near 20,000E, with lows on either side of the central high or highs. The high values at the east end of the profile are due to the presence of outcropping bedrock. Indications are that the total excursion in gravity values was not reached at either end of the line. Certainly the gravity values continue to increase past the east end of the line until a final plateau is reached. Gravel thickness estimates near 27,000E, based on the level change between an assumed gravity value on the projected curve beyond the eastern extent of the line, and the low centered at 27,000E give depths of 1500' to 2000' which are compatible with the drill results. The western end of the line is somewhat uncertain as the subsurface geology is unknown. The high values centered near 20,000E appear to be buried ridges although they could be simply reflecting rock type (density) changes in the subsurface. The anomaly at 20,000E actually consists of two highs centered near 17,000E and 22,000E indicating two ridges. The structural breaks indicated on the profile are related to the highs and lows as shown on the profile map. These structural breaks could be due to changes in bedrock topography or rock type. At any rate the gravity

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profile does not suggest a smoothly sloping pediment but rather one having quite abrupt changes in topography. The drilling to date, which indicates in excess of 2,000' of gravels in the vicinity of the gravity high while only 1400' of gravels near the low makes the case for a simple two dimensional geological model unreasonable.

Two geologic possibilities which could account for both the gravity profile and drill results are: 1) A gradually increasing thickness of gravels to the west as suggested by the drilling, in conjunction with one or more density contrasts within the basement rocks. 2) The gravity data is strongly influenced by lateral effects north and south of the traverses. This, for example, could be caused by north-south trending ridges on either side of the profile opposite the gravity highs near 17,000E and 22,000E, flanked by thicker basin material on each side and in between. This may imply some unknown east-west (?) structure(s) in the vicinity of the drill holes which have truncated these north-south ridges. The first possibility seems remote because of the rather large density contrasts necessary to produce the observed gravity profile. The latter assumption seems more plausible, particularly in view of the outlier of volcanics which outcrops approximately 4 miles to the northwest. Likely the true subsurface geology is some combination of both these possibilities.

Because of the geologic complexities involved, a detailed interpretation, including more refined depth estimates, does not seem warranted based on the data presently available. However, the gravity information does indicate that there are uplifted blocks or changes in the bedrock topography within the covered area which can perhaps be prospected effectively.

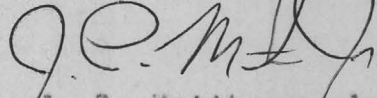
In view of the several possibilities which exist, considerable additional field work and study will be necessary in order to resolve the subsurface geology. This would include, but not be limited to, several gravity profiles in some reasonable grid. This should at least tell us if lateral effects are causing the anomaly and give a fair picture of the subsurface topography in a three dimensional sense. Depending on the objectives, deep resistivity, and I.P. methods might also be employ-

Mr. J. E. Worthington
January 18, 1973
Page Four

ed. With careful work effective penetration depths of 1,500 feet and as much as 2,000 feet can be attained electrically. This might well give penetration into or even through the subsurface volcanics. In addition, a careful correlation study of the gravity data with the recent aerial magnetic survey completed by Cyprus, and available drill logs would be helpful. The cost of performing this additional work, at least the initial stages, is estimated at \$2,000.00 to \$5,000.00.

Very truly yours,

Heinrichs GEOExploration Co.



J. P. Matthews, Jr.
Geophysicist



Chris S. Ludwig
Chief Geophysicist

JPM:oeK

cc Enclosed

CYPRUS MINES CORPORATION

523 WEST SIXTH STREET
LOS ANGELES, CALIFORNIA 90014
TELEPHONE 629-5771

December 27, 1972

Heinrichs Geoexploration Company
P. O. Box 5964
Tucson, Arizona 85703

HEINRICH
GEOEX

Cable: GEOEX



REC'D JAN 2 1973 REC'D
BOX 5964 TUCSON, ARIZONA 85703
Phone: (-REA 602) 623-0578

Gentlemen:

Enclosed is a fully-executed agreement for your services in performing
a gravity survey at Copper Creek.

Very truly yours,

M. W. Seery
Administrative Staff Geologist

MWS/sc
enclosure

cc: Mr. J. E. Worthington
Mr. G. S. Branson

Job 785

AGREEMENT FOR SERVICES

(NOTE: If space provided herein is insufficient to permit a complete entry of the required information, attach a page marked as "Exhibit ____" and enter the words, "See Exhibit ____" in the available space.)

THIS AGREEMENT, made and entered into as of the
22 day of December, 1972, by and between
Cyprus Mines Corporation

(herein called "Company") and Heinrichs GEOEXploration
Company (herein
called "Contractor")

In consideration of the premises and the mutual covenants of the parties herein set forth, the parties agree as follows:

1. Contractor agrees to perform services for Company consisting of A Gravity Survey and technical report of a Line near Copper Creek Road in Pinal County Arizona

2. In futherance of its undertaking to perform the aforesaid services, Contractor agrees to furnish equipment consisting of a gravity meter and Altimeters, and personnel consisting of a two man crew, and to cause said equipment to be operated and/or said personnel to work 8 hours per day, 5 days per week. ^{See Exhibit A} Except for such additional equipment and/or personnel as Company either herein or subsequently agrees in

writing to provide for Contractor's use, all equipment and/or personnel required by Contractor to perform the services herein specified shall be provided by Contractor at his sole cost and expense.

3. As total compensation for the services to be rendered by Contractor, and the equipment and/or personnel to be furnished by Contractor, Company agrees to pay Contractor at the rate of ~~as described in exhibit A~~, payable ~~on presentation of billing~~. Company shall have the right to audit all records and accounts of Contractor relating to any materials, supplies and services actually furnished hereunder by Contractor on a cost-plus basis.

4. Company agrees to furnish Contractor with the following equipment and/or personnel for his use in performing the services herein called for: ~~NONE~~.

5. The term of this Agreement shall commence on or about January 1, 1972, the exact starting date to be mutually agreed upon by the parties, and shall continue until either the project is completed to Company's satisfaction or this Agreement is terminated by either party giving 10 days' advance written notice to the other party.

6. The location(s) at which the services of Contractor are to be rendered is ~~along Copper Creek road in Pinal County Arizona and as directed by Company~~.

7. Contractor shall at all times be acting as an independent contractor and shall in no way be considered an employee or agent of Company. Company shall specify the work to be performed and the geographical area wherein the work is to be performed, but Contractor shall independently select the means of achieving the results desired by Company.

8. Contractor shall maintain strict security over all knowledge and information acquired or developed by it during the performance of this Agreement. Contractor shall not divulge any such knowledge and information directly or indirectly to any person, other than the authorized representatives of Company, without the prior written consent of Company.

9. Contractor agrees to indemnify and save Company harmless from and against any and all loss, damage, injury, liability, and claims therefor, resulting directly or indirectly to any party or person who may be in any manner injured or damaged by any act or omission of Contractor, his servants, or agents in the performance of this Agreement.

Contractor will obtain and continue in force, during the term of this Agreement, at its own expense, all insurance specified below. Contractor will not commence work nor allow any subcontractor to commence work until

all insurance has been approved and accepted by Company.

The insurance to be obtained and continued in force by Contractor is the following:

- (a) Workmen's Compensation and Occupational Disease Disability insurance as required by the laws of the state wherein the work is to be performed.
- (b) Employer's Liability insurance, unless the laws of the state in which the work is to be performed preclude an independent right of action by an employee against an employer under common law.
- (c) Comprehensive Automobile Liability insurance with Bodily Injury limits of no less than \$100,000 each person and \$300,000 each accident and Property Damage with a limit of no less than \$50,000 each accident.
- (d) Comprehensive General Liability and Property Damage insurance including Operation, Protective and Contractual Liability coverages with Bodily Injury limits of no less than \$100,000 each person and \$300,000 each occurrence; and Property Damage limits of no less than \$100,000 each occurrence, and

\$300,000 aggregate operations, \$300,000
aggregate protective, \$300,000 aggregate
contractual.

Any exclusion of the insurance pertaining to
(1) damage to underground property, (2) collapse of
structures, or (3) damage resulting from explosion or
blasting, shall be deleted.

Contractor shall furnish Company with certificates
of insurance which shall include the following statements:

- (aa) At least ten (10) days prior to the effective date of any material change or cancellation, written notice thereof will be sent by registered mail to Cyprus Mines Corporation, 523 West Sixth Street, Los Angeles, California 90014.
- (bb) The Contractual Liability insurance covers the liability of the insured assumed under the indemnity and insurance provisions of the within Agreement.
- (cc) The Comprehensive General Liability insurance covers (1) damage to underground property, (2) collapse of structures, or (3) damage resulting from explosion or blasting.

10. "Force Majeure" as used herein refers to acts of God, action of the elements, strikes, civil disturbances and other causes of equivalent force not caused by nor within the control of either party hereto. If by reason of force majeure Contractor shall be prevented from performing the services herein contracted for, Contractor shall give notice and full particulars in writing to Company. The obligations of both parties hereunder shall then be suspended for so long as Contractor's inability to perform continues; provided, however, that nothing herein contained shall be construed to preclude either of the parties from exercising its right to terminate this Agreement in accordance with Paragraph 5.

11. All certificates, notices, affidavits, or other documents prepared by Contractor in connection with the services performed pursuant to this Agreement shall be approved by Company prior to the delivery of such documents to any governmental agency or other third party.

12. Any notices permitted or required to be given hereunder shall be deemed to have been received if mailed by registered mail, postage prepaid, and addressed as follows:

If to Company:

Cyprus Mines Corporation
523 West Sixth Street
Los Angeles, California 90014

If to Contractor:

Heinrichs GEOEXploration Co.

P.O. Box 5964

Tucson, AZ 85703


12. This Agreement may not be assigned by Contractor without the prior written consent of Company. This Agreement may not be assigned by Company, except to a wholly-owned subsidiary of Company, without the prior written consent of Contractor.

IN WITNESS WHEREOF, the parties have executed this instrument on the day and year first above written.

COMPANY

CYPRUS MINES CORPORATION

BY

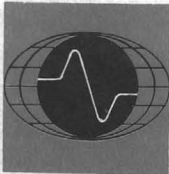

Vice President & Comptroller

MWS

CONTRACTOR

Heinrichs GEOEXploration Co.


Walter E. Heinrichs, Jr.
President and General Manager



HEINRICHS GEOEXPLORATION COMPANY

806 WEST GRANT ROAD, TUCSON, ARIZONA 85703. P.O. BOX 5964. PHONE: (602) 623-0578

December 21, 1972

Exhibit A

Cyprus Mines Corp.
1200 Pacific Mutual Bldg
523 West Sixth Street
Los Angeles, CA 90014

Re: GEOEX Job #785

The gravity survey we discussed November 27, by phone seems to be fairly straight forward and the \$2,000.00 quoted should be more than adequate to obtain the six miles of gravity data in question. This assumes that only the major structural features will be of interest and, therefore, requiring only altimeter elevation control.

The traverse line running down Copper Creek Road will present no severe technical problem so long as minor gravity effects can be ignored. The long ridge line is relatively symmetrical and should cause no topographic anomaly of similar strength as expected fault block anomaly in the San Pedro Valley.

Quarter mile station spacing may be adequate to shape the anomaly expected, however, 500 foot intervals may be desired to detail some parts of the traverse. Approximately 40 to 60 readings, counting base checks will be required and should require two to three field days.

A minimum of \$500.00 rental for a gravity meter is required by Texas Instruments and we would bill this at our invoice cost plus 15 percent. No problem is anticipated obtaining an instrument within the next month or two so long as a loose schedule is possible. We will use a two man crew charged at \$175.00 per work day plus

Exhibit A
December 21, 1972
Page Two

expenses. Expenses will include \$33.00 per day living expenses, \$15.00 per day and \$0.15 per mile for a field vehicle.

Care will be taken to see that each station is set and so located that a precise level survey can be done, if required, at a later date.

Data reduction, interpretation, and report will be billed at \$18.75 per hour, drafting and clerical time will be billed at \$10.00 per hour. Communications and miscellaneous supplies will be billed at cost plus 15 percent.

Additional gravity work within 400 miles of Tucson will be done at the same rate, and GEOEX will absorb the instrument rental for the second month if an additional 22 work days of gravity work can be guaranteed.



Neenah Onionskin
25% COTTON FIBER

CYPRUS MINES CORPORATION

W. 422 RIVERSIDE AVENUE
SPOKANE, WASHINGTON 99201
PHONE: AC 509 - MA 4-8902

December 18, 1972

HEINRICHS
GEOEX

Cable: GEOEX



Mr. Paul A. Head
Heinrichs Geoexploration Company
P. O. Box 5964
Tucson, Arizona 85703

REC'D DEC 21 1972 REC'D
BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Dear Paul:

We should like to request that you go ahead with the gravity survey along the Copper Creek road as outlined in your letter of November 29th. You may start as soon as you like, but we request that you do not invoice us until after January first. We should also like to have the work completed and reported prior to January 25th. I am enclosing 2 copies of our standard service agreement and request that you fill them in as with past agreements. You may then forward them directly to Major Seery in our Los Angeles office.

Very truly yours,

Joseph E. Worthington
ed

Joseph E. Worthington
United States Manager of Exploration

JEW:ldl
Enc.
cc: C. A. Mark

Geoex Sub 785

November 29, 1972

Job # 785

Mr. Joseph E. Worthington
Regional Exploration Manager
Cyprus Mines Corp.
West 422 Riverside Avenue
Spokane, Washington 99201

Dear Joe:

The gravity survey we discussed November 27 by phone seems to be fairly straight forward and the \$2,000.00 quoted should be more than adequate to obtain the six miles of gravity data in question. This assumes that only the major structural features will be of interest and, therefore, requiring only altimeter elevation control.

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A minimum of \$500.00 rental for a gravity meter is required by Texas Instruments and we would bill this at our invoice cost plus 15 percent. No problem is anticipated obtaining an instrument within the next month or two so long as a loose schedule is possible. We will use a two man crew charged at \$175.00 per work day plus

Mr. J. E. Worthington
November 29, 1972
Page Two

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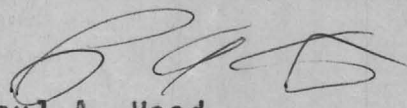
Care will be taken to see that each station is set and so located that a precise level survey can be done, if required, at a later date.

Data reduction, interpretation, and report will be billed at \$18.75 per hour, drafting and clerical time will be billed at \$10.00 per hour. Communications and miscellaneous supplies will be billed at cost plus 15 percent.

Additional gravity work within 400 miles of Tucson will be done at the same rate, and GEOEX will absorb the instrument rental for the second month if an additional 22 work days of gravity work can be guaranteed.

Sincerely yours,

Heinrichs GEOEXploration Co.



Paul A. Head
Geophysicist

PAH:ook

AGREEMENT FOR SERVICES

(NOTE: If space provided herein is insufficient to permit a complete entry of the required information, attach a page marked as "Exhibit ____" and enter the words, "See Exhibit ____" in the available space.)

THIS AGREEMENT, made and entered into as of the
22 day of December, 19 72, by and between
Cyprus Mines Corporation
(herein called "Company") and Heinrichs GEOEXploration
Company (herein
called "Contractor")

In consideration of the premises and the mutual covenants of the parties herein set forth, the parties agree as follows:

1. Contractor agrees to perform services for Company consisting of A Gravity Survey and technical report of a Line near Copper Creek Road in Pinal County Arizona

2. In futherance of its undertaking to perform the aforesaid services, Contractor agrees to furnish equipment consisting of a gravity meter and Altimeters, and personnel consisting of a two man crew, and to cause said equipment to be operated and/or said personnel to work 8 hours per day, 5 days per week. / Except for such additional equipment and/or personnel as Company either herein or subsequently agrees in

GEOEX
Job # 785

writing to provide for Contractor's use, all equipment and/or personnel required by Contractor to perform the services herein specified shall be provided by Contractor at his sole cost and expense.

3. As total compensation for the services to be rendered by Contractor, and the equipment and/or personnel to be furnished by Contractor, Company agrees to pay Contractor at the rate of as described in exhibit A, payable on presentation of billing.

Company shall have the right to audit all records and accounts of Contractor relating to any materials, supplies and services actually furnished hereunder by Contractor on a cost-plus basis.

4. Company agrees to furnish Contractor with the following equipment and/or personnel for his use in performing the services herein called for: NONE

5. The term of this Agreement shall commence on or about January 1, 19 72, the exact starting date to be mutually agreed upon by the parties, and shall continue until either the project is completed to Company's satisfaction or this Agreement is terminated by either party giving 10 days' advance written notice to the other party.

6. The location(s) at which the services of Contractor are to be rendered is along Copper Creek road in Pinal County Arizona and as directed by Company.

7. Contractor shall at all times be acting as an independent contractor and shall in no way be considered an employee or agent of Company. Company shall specify the work to be performed and the geographical area wherein the work is to be performed, but Contractor shall independently select the means of achieving the results desired by Company.

8. Contractor shall maintain strict security over all knowledge and information acquired or developed by it during the performance of this Agreement. Contractor shall not divulge any such knowledge and information directly or indirectly to any person, other than the authorized representatives of Company, without the prior written consent of Company.

9. Contractor agrees to indemnify and save Company harmless from and against any and all loss, damage, injury, liability, and claims therefor, resulting directly or indirectly to any party or person who may be in any manner injured or damaged by any act or omission of Contractor, his servants, or agents in the performance of this Agreement.

Contractor will obtain and continue in force, during the term of this Agreement, at its own expense, all insurance specified below. Contractor will not commence work nor allow any subcontractor to commence work until

all insurance has been approved and accepted by Company.

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- (a) Workmen's Compensation and Occupational Disease Disability insurance as required by the laws of the state wherein the work is to be performed.
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- (c) Comprehensive Automobile Liability insurance with Bodily Injury limits of no less than \$100,000 each person and \$300,000 each accident and Property Damage with a limit of no less than \$50,000 each accident.
- (d) Comprehensive General Liability and Property Damage insurance including Operation, Protective and Contractual Liability coverages with Bodily Injury limits of no less than \$100,000 each person and \$300,000 each occurrence; and Property Damage limits of no less than \$100,000 each occurrence, and

\$300,000 aggregate operations, \$300,000 aggregate protective, \$300,000 aggregate contractual.

Any exclusion of the insurance pertaining to (1) damage to underground property, (2) collapse of structures, or (3) damage resulting from explosion or blasting, shall be deleted.

Contractor shall furnish Company with certificates of insurance which shall include the following statements:

(aa) At least ten (10) days prior to the effective date of any material change or cancellation, written notice thereof will be sent by registered mail to Cyprus Mines Corporation, 523 West Sixth Street, Los Angeles, California 90014.

(bb) The Contractual Liability insurance covers the liability of the insured assumed under the indemnity and insurance provisions of the within Agreement.

(cc) The Comprehensive General Liability insurance covers (1) damage to underground property, (2) collapse of structures, or (3) damage resulting from explosion or blasting.

10. "Force Majeure" as used herein refers to acts of God, action of the elements, strikes, civil disturbances and other causes of equivalent force not caused by nor within the control of either party hereto. If by reason of force majeure Contractor shall be prevented from performing the services herein contracted for, Contractor shall give notice and full particulars in writing to Company. The obligations of both parties hereunder shall then be suspended for so long as Contractor's inability to perform continues; provided, however, that nothing herein contained shall be construed to preclude either of the parties from exercising its right to terminate this Agreement in accordance with Paragraph 5.

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523 West Sixth Street
Los Angeles, California 90014

If to Contractor:

Heinrichs GEOEXploration Co.

P.O. Box 5964

Tucson, AZ 85703

12. This Agreement may not be assigned by Contractor without the prior written consent of Company. This Agreement may not be assigned by Company, except to a wholly-owned subsidiary of Company, without the prior written consent of Contractor.

IN WITNESS WHEREOF, the parties have executed this instrument on the day and year first above written.

COMPANY

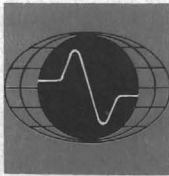
BY _____

CONTRACTOR

Heinrichs GEOEXploration Co.



Walter E. Heinrichs, Jr.
President and General Manager



HEINRICHS GEOEXPLORATION COMPANY

806 WEST GRANT ROAD, TUCSON, ARIZONA 85703. P.O. BOX 5964. PHONE: (602) 623-0578

December 21, 1972

Exhibit A

Cyprus Mines Corp.
1200 Pacific Mutual Bldg
523 West Sixth Street
Los Angeles, CA 90014

Re: GEOEX Job #785

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The traverse line running down Copper Creek Road will present no severe technical problem so long as minor gravity effects can be ignored. The long ridge line is relatively symmetrical and should cause no topographic anomaly of similar strength as expected fault block anomaly in the San Pedro Valley.

Quarter mile station spacing may be adequate to shape the anomaly expected, however, 500 foot intervals may be desired to detail some parts of the traverse. Approximately 40 to 60 readings, counting base checks will be required and should require two to three field days.

A minimum of \$500.00 rental for a gravity meter is required by Texas Instruments and we would bill this at our invoice cost plus 15 percent. No problem is anticipated obtaining an instrument within the next month or two so long as a loose schedule is possible. We will use a two man crew charged at \$175.00 per work day plus

Exhibit A
December 21, 1972
Page Two

expenses. Expenses will include \$33.00 per day living expenses, \$15.00 per day and \$0.15 per mile for a field vehicle.

Care will be taken to see that each station is set and so located that a precise level survey can be done, if required, at a later date.

Data reduction, interpretation, and report will be billed at \$18.75 per hour, drafting and clerical time will be billed at \$10.00 per hour. Communications and miscellaneous supplies will be billed at cost plus 15 percent.

Additional gravity work within 400 miles of Tucson will be done at the same rate, and GEOEX will absorb the instrument rental for the second month if an additional 22 work days of gravity work can be guaranteed.

December 21, 1972

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Cyprus Mines Corp.
1200 Pacific Mutual Bldg
523 West Sixth Street
Los Angeles, CA 90014

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Care will be taken to see that each station is set and so located that a precise level survey can be done, if required, at a later date.

Data reduction, interpretation, and report will be billed at \$18.75 per hour, drafting and clerical time will be billed at \$10.00 per hour. Communications and miscellaneous supplies will be billed at cost plus 15 percent.

Additional gravity work within 400 miles of Tucson will be done at the same rate, and GEOEX will absorb the instrument rental for the second month if an additional 22 work days of gravity work can be guaranteed.